CONTRIBUTION TO THE STUDY OF NEPHROLITHIASIS.

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TWO especially interesting operations for the relief of renal calculus, occurring in the practice of Professor A. C. Bernays, were my incentive to a review of the history of this operation, and an investigation of the newer revelations in the pathology of nephrolithiasis. I submit the fruits of my research with a report of the two cases mentioned.

Prior to these considerations, however, a proper terminology demands our attention, and it is of especial importance on account of existing confusion in the use of names applied to the operations for nephrolithiasis.

The word " nephrolithotomy" was first proposed by Professor James Israel, who applied it only to the operation of cutting into the *pelvis* of the kidney for stone, and it is so accepted by no less an authority than Professor Rosenstein in his great work on " Internal Medicine." But this word is capable of a second interpretation,—viz., to cut into the *kidney substance proper* for a stone located therein. To this it seems more applicable, and I shall so use it. " Pyelotomy" is the term first proposed by Professor Czerny for cutting into the pelvis for stone, and it is certainly a more intelligible name than nephrolithotomy, as applied by Israel, to the same procedure. I will go one step further and propose "pyelolithotomy" as the only term conveying full meaning when applied to the operation of cutting into the *pelvis* of the kidney for stone, in contradistinction to nephrolithotomy for stone in the kidney substance proper. Strictly limiting each term, pyelotomy is to be used with nephrotomy, as proposed by Czerny, for simple incision into the kidney, and not applied by him to any of the stone operations; nephrectomy, however, as the only name for complete excision of the organ, must be so applied.

I propose, then, as a complete nomenclature for the surgical treatment of nephrolithiasis, the terms nephrectomy, nephrolithotomy, and pyelolithotomy, calling those operations "primary" which are undertaken simply for the removal of a stone, as distinguished from the "secondary" ones necessitated by tissue changes consequent upon its presence.

Some sort of operative procedure for the relief of renal calculus has been known and practised since the days of Hippocrates, who is said to have advised a lumbar incision, probably in cases of renal or perirenal abscess caused by stone, as Hevin, Rayer, and Smith did later. It is supposed that Marchetti was the first (in 1696) to cut into the kidney in search of a stone.

In 1770, Hevin collected reports of thirteen operations for the removal of renal calculi. In none of these, however, is it certain that the kidney substance was really invaded, and not simply a renal abscess opened. Rayer persuaded Velpeau to do some such operation, and the same was done later by Bryant and Callender. Erlich's "Surgery," of 1815, asserts that he did a similar operation, making an incision over the left kidney, and, after much manipulation, bringing forth a branched stone of considerable size. This variety of surgery does not seem to have attracted much attention among the English until 1869, when Mr. Thomas Smith read a paper on the subject before the Medico-Chirurgical Society of London, and following the suggestions of that article Mr. Thornton operated in 1878. The foregoing seem all to have been secondary operations, as I have defined the word; while Mr. Henry Morris claims credit for the first primary lumbar stone operation, in which claim he is sustained by Kendal Franks, Heath, Treves, Thornton, and others. His operation, a successful one, was performed in October, 1880. This is disputed by E. Herczel, of Heidelberg, who says that Czerny first suggested a primary operation in 1880, and that E. Norris was the first one to carry it out in the same year. Since then the operation has been done by many surgeons, the earliest operators were Reginald Harrison, Lucas, Jordan Loyd, James Israel, and G. Simon, of Heidelberg.

Recent pathological investigations have shown that for the formation of renal calculi as of gall-stones two prime factors must co-operate,—viz., (1) stagnation and (2) infection. Stagnation is most often produced in one of the following ways: (1) Displacement of the kidney and consequent bending or twisting of the ureter; (2) pressure on the ureter; (3) atrophy of the muscular coat of the pelvic and ureteric walls, this last explaining in part the fact that stone is much more common in old than young adult life. Another reason for this is the resorption, in the aged, of bony tissue, and the setting free into the circulation of the very material needed to form calculi.

Infection (pyelonephritis) occurs as a result of one of three processes: (1) (descending) Infection from the circulation in septicæmic conditions. (2) (ascending) Infection from a focus lower in the urinary tract. (3) Transmission from neighboring organs by contiguity. The growth of colonies of bacteria in all directions is favored by stagnation, while epithelium shed as a result of the infective process furnishes a convenient nucleus. The frequency of infectious manifestations in the kidney during the diseases peculiar to childhood partly explains the fact that renal calculus is more common at this than at any other period of life. Accessory conditions to such formation are: (1) Excess of precipitable salts in the urine; (2) too acid or too alkaline a reaction, either of which lessens the solvent power of urine; (3) presence of any floating substance that might form a nucleus,—viz., albumen, a clot, mucus, a colony of bacteria, or desquamated epithelium, as above noted. In addition to the concretions of renal origin, it is a fact worthy of note that gall-stones have been found in the pelvis of the kidney as a result of perforation.

Etiologically speaking, we must not forget the greater prevalence of renal calculi in districts where " lime-water" is drunk and in the chalk countries. In the United States, east of the Mississippi, the affection is most common, in Ohio, Kentucky, Tennessee, North Carolina, Alabama, and Virginia.

CASE I.—The patient, male, aged twenty-five years, of low stature, heavy set, dark complexion, by occupation is a saw-filer.

Family history: The father, an Englishman, is forty-eight year of age and living, has suffered for years with "gravel," and the digestive disturbance known as "water-brash." The mother, an Irish woman, forty-six years of age, has suffered much from digestive troubles, has borne nine children. Four of the nine children are living, of whom three have always enjoyed good health, except in early childhood, when the acute diseases peculiar to this age were experienced by all; of the other five two died of diphtheria in early childhood; a third in childhood, cause unknown; a fourth at seventeen, cause unknown; and the last at twenty-four, of undiagnosed kidney and liver trouble, when seven months pregnant. The element of heredity in nephrolithiasis is marked in this family. The father suffered with gravel, and a sister died from what seems to have been a kidney-disease.

The patient was born in Montreal and experienced the ordinary acute diseases of childhood. He gives a history of general digestive disturbance existing since the age of thirteen. At intervals from fourteen to twenty-one he experienced the peculiar sensation of "a marble rolling around in the left side," to put it in his own words. His first attack of renal colic was at twenty-two and in the right side (illustrating the interesting fact to which Thornton first called attention, that stone in one organ sometimes caused pain to be referred to the opposite side). The very first of these colicky attacks was so severe as to cause vomiting. They continued to occur spontaneously day or night, and with varying intensity for eight months, often as many as four or five in twenty-four hours; but he never, to his knowledge, passed gravel. Sometimes he could retained his urine for six hours, but again no more than a half hour. He was then free from pain for six months, when the left kidney was attacked for the first time, this attack lasting but a few days, then no more such trouble for nine months. In April, 1893, he contracted gonorrhœa, which did not cease causing him discomfort until May, 1894. In August, 1894, he incurred a so-called malarial attack, which lasted four months. Pain in the left kidney returned for a few days in January, 1894. In August and September he had pain in the left kidney every few days, after which he was free from it until late in December. About the middle of January, 1895, he noticed hæmaturia for the first time, and only once. Then two weeks later it returned and was constant for two or three days. During the next week his urine was clear, then bloody again for two days. Up to this time no pain had accompanied the hæmaturia. Early in February the blood appeared again and at the same time excessive pain in the left kidney and testicle. From this date until the operation the hæmaturia was intermittent, a few days of clear urine alternating with the same length of time in which blood was constant. Pain was continuous and excruciating until the middle of March, since which time the patient's existence has been fairly tolerable.

May 3, 1895, I examined the urine. A probable diagnosis of nephrolithiasis had been.made by Dr. W. W. Graves. It was based on the clinical aspects of the case. The urine was smoky, almost opaque, and, upon settling, presented a heavy sediment.

There were revealed upon examination,—chemical and physical: color red; specific gravity 1028; reaction acid; albumen present (three tests); sugar none.

Microscopical Examination.—Calcium oxalate crystals; calcium carbonate; red blood cells; red blood-cell casts; polynuclear leucocytes; streptococci.

The oxalate crystals were most of them the brilliant refractive quadratic octohedra.

No effort was made to ascertain the kind of streptiform bacteria present. The red blood-corpuscles and casts of same together with the clinical history pointed to one of three conditions: tuberculosis of the kidney, malignancy or calculus, the presence of calcium oxalate crystals, making the last one by far the most probable diagnosis. Based on the above, surgical treatment was decided upon and the patient sent to Pius Hospital of this city.

May 9, at 10 A.M., the operation was performed. The patient was placed on the right side with a block under him. A five-inch incision was made parallel to the twelfth rib and one-half inch below it, with its middle point a little behind the axillary line. This incision is invariably used by Professor Bernays in operating on the kidney. The peritoneum was unusually high in this case and formed the floor of the wound. On pushing aside this membrane the fatty capsule of the kidney was exposed. This was quickly torn through and the organ itself completely laid bare. As nothing abnormal could be seen or felt, an exploratory puncture of the kidney substance was made, but still no stone detected. The post-mortem incision was now made through the capsule, the deeper kidney substance was separated by the finger-nail, thus avoiding excessive hæmorrhage, and the much-sought-for stone found firmly embedded in the pelvis, whence all efforts to dislodge it with a curette were fruitless. It was finally caught with a long tissue forceps and extracted after some manipulation. Oozing from the kidney substance was inconsiderable, but to insure perfect drainage a small rubber tube wrapped with gauze was left extending from the pelvis without the external wound, which in the rest of its extent was closed with interrupted silk sutures, none of any kind being used in the kidney. The entire operation required but twenty-six minutes for its completion.

The stone, one of the mulberry form, is covered with calcium oxalate crystals. Its weight is twenty-six and a quarter grammes. In shape it may be called irregularly pyramidal, its three greatest dimensions being nine-sixteenths, eight-sixteenths, and five-sixteenths inch respectively.

The patient made an uninterrupted recovery. Slight leakage of urine persisted until June 1, when the external wound closed perfectly. On the fourth day after the operation the urine cleared up, and, with the exception of a few slightly-tinged discharges, has remained so. When he left the hospital, June 6, I could discover in the urine neither red blood-corpuscles nor oxalate crystals, but there were many polynuclear leucocytes in evidence of a persistent pyelitis. Chemically were shown serum, albumen, and nucleo-albumen. If not perfectly well, this man has exchanged a miserable existence for one of perfect comfort and correspondingly good spirits.

Case II.—The patient, Mr. McA., presented himself for treatment in March. He is tall, sparely built, and walks with his body slightly bent to the left side. He is twenty years of age and comes of a healthy family. He has been a sufferer from colicky attacks in the left side since his eighth year. Sometimes as many as seven distinct paroxysms have occurred in a day. Several times these seizures have caused vomiting and nearly rendered him unconscious. They often come on while he is perfectly quiet, no kind of diet or regimen influencing them in the least.

Inspection of his body reveals nothing abnormal; no increase in size of the left kidney can be detected, but pressure over this organ is very painful. He passes his urine about every two hours, but sometimes sleeps six hours without doing so. The urine when fresh is of a clear amber color. After standing, a slight cloud appears. Specific gravity varies from 1012 to 1020. Albumen is always present.

Microscopical pus cells are seen, also envelope-crystals of calcium oxalate and red blood-corpuscles, but never enough of the last to warrant a microscopical diagnosis of hæmaturia. However, the patient states that at one time, while riding over a very rough road, his urine was red, and, at that time, it no doubt contained many more red corpuscles than these examinations revealed. A diagnosis of renal calculus was made and the patient sent to the Pius Hospital, where at 10 A.M., April 10, Professor Bernays performed the following operation:

An incision about five inches long was made parallel to the twelfth rib and about a half inch below it, extending from the sacro-lumbar muscle to the axillary line down to the kidney, and entirely extraperitoneally. After being enucleated from its fatty capsule the kidney was found entirely normal in size and appearance. No stone could be felt on most careful palpation of kidney and pelvis. Feeling certain of his diagnosis, Professor Bernays inserted the needle of an ordinary hypodermic syringe along the convexity of the kidney in the direction of its pyramids. After three or four unsuccessful attempts it struck a hard obstacle apparently in the substance of the kidney. Having thus located the stone he split the fibrous capsule of the kidney for half an inch and then bored his index-finger in the parenchyma, quite easily separating the tissue down to the stone. This was removed from its bed by a large Simon's curette.

There was very little hæmorrhage; the small lacerated wound in the kidney being soon closed by a blood-clot and requiring no suture. The external wound was closed by deep and superficial sutures except where a rubber drainage-tube was left reaching down to the point where the stone had been.

The wound healed entirely by first intention, not one drop of urine ever escaping. No pus ever appeared, and there never was any pain after the operation; but the urine continued bloody for four days, after which it gradually cleared up. The patient left the hospital on the twenty-first day.

The stone is two centimetres in its largest and one and a half in its shortest diameters, is flat, and only three-quarters centimetre in thickness. The entire surface is studded with calcium oxalate crystals, which refract light in a beautiful way.

From the literature of the subject at my command and these two cases, I draw the following conclusions:

(1) The transverse lumbar incision is preferable to any other.

(2) When reasonably sure of his diagnosis, although, as in Case I, palpation and puncture reveal nothing, the surgeon is justified in tearing open the secreting portion of the kidney, in the search for a stone, before giving it up as a case of mistaken diagnosis.

(3) In opposition to James Israel,[1] the use of the knife on kidney substance to get at a stone within is not to be recommended. Much preferable is Professor Bernays's method of simply cutting the capsule and pushing the finger bluntly through the tissues. The lacerated wound bleeds but little, and the torn walls readily approximate one another.

(4 (*a*) Nephrolithotomy is the proper operation in cases of nephrolithiasis, except in the conditions to be detailed under (*b*) and (*c*).

(*b*) Pyelolithotomy is to be done only when a stone is easily felt in the pelvis of the kidney.

(*c*) Nephrectomy is permissible only in those cases in which the secreting substance of the affected organ is almost completely destroyed and the opposite kidney known to be healthy, which can be accurately determined only by catheterization of the ureters, a procedure which in the male is by no means common. Against nephrectomy must be urged the fact, that the affected organ may be a *solitary* one,—*i.e.*, the possibility that there is only one kidney. If it has a companion, this second one is quite likely to be similarly affected.

(5) The extraperitoneal operation is decidedly preferable to that through the anterior abdominal parietes. The urine in nephrolithiasis always contains pathogenic bacteria, so that the reason for this choice is obvious.

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